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ARIZONA DEPARTMENT OF WATER RESOURCES
HYDROLOGY DIVISION

M E M O R A N D U M

TO: Recharge Committee

FROM: Tom Harbour, Surface Water Section, Hydrology

DATE: June 2, 1995

SUBJ: Review Procedures for Recovery Well Permit Applications

Until recently the focus of ADWR's recharge program has been on review and processing of Underground Storage Facility, Groundwater Savings Facility and associated Water Storage Permits. However, now that the recharge program is fully operational and numerous facilities are storing large amounts of water, applications for recovery well permits are expected to increase dramatically as stored water is put to use and long term storage credits are marketed. The recharge statutes allow a city, town, private water company or irrigation district to have all existing wells in their service area designated as recovery wells which could make it difficult to meet statutory review time limits in light of existing workloads. Therefore, in anticipation of an increasing number of recovery well permit applications, it seems appropriate to establish review policy and procedures to ensure efficient, consistent and timely permitting.

Recovery of water stored pursuant to a water storage permit requires an applicant to obtain a Recovery Well Permit. Review of a recovery well permit application requires involvement of Operations, AMAs, Legal and Hydrology Divisions. The purpose of this memo is to review the legal requirements for recovery of stored water, to propose procedures for recovery well permit application review, and to highlight areas where guidance on certain policy issues is necessary.

Legal Requirements for Recovery of Stored Water

The legal provisions regarding recovery of stored water are discussed under A.R.S. § 45-834.01. Subsection A of the statute describes where recovery can occur and subsection B lists requirements necessary to obtain a permit to recover water.

A person who holds long term storage credits or intends to recover stored water annually must meet the following criteria for the location of the recovery well:

1. Generally, stored water does not have to be recovered in the exact location that it was stored, but if storage occurred in an AMA, it must be recovered in the same AMA.

2. If recharge occurred in an AMA, the storer can always recover the stored water from within the actual area of impact (AOI) of the stored water. The AOI is defined by A.R.S. § 45-802.01(2) as "..projected on the land surface, the area where the stored water has migrated or is located". For underground storage facilities, this has been interpreted to be the area encompassed by the 1 foot rise in equipotential on the existing potentiometric surface resulting from the recharge.

Policy Note 1: The area of impact for a Groundwater Savings Facility (unlike a USF) is defined by the aerial extent of the service area boundary of the recipient, usually an irrigation district, or other water provider. If the recipient is not a water provider, the AOI would be the area where the groundwater would have been pumped but for receipt of the in-lieu water. For purposes of this paragraph, only the AOI associated with an underground storage facility is considered.

a. For recovery within the AOI, the storer is not required to demonstrate consistency with management plan or achievement of management goal.

b. The actual area of impact must be calculated at the end of each calendar year by the water storage facility permit holder. If the storer claims the AOI extends farther than the 1 mile safe harbor (see Policy note 2), the AOI can be calculated analytically (Hantush or Theis solutions), using actual recharge and recovery (from within the AOI) reported that year. This "snapshot" area of impact will serve as the actual area of impact for the entire year following the calculation.

Policy Note 2: There is always a "safe harbor" minimum area of impact that, by DWR policy interpretation, is deemed to extend outward in a one mile radius from the storage site. Thus, a storer need not calculate actual area of impact for years in which the storer does not wish to extend its actual area of impact beyond the one mile radius "safe harbor."

3. Recovery of stored water is allowed outside of the AOI (but within the same AMA as the site of storage), or inside AOI by a person other than the storer, if the recovery is consistent with the management plan and achievement of management goal for that AMA. To be deemed consistent with the management plan and achievement of the management goal for the AMA, the recovery site must meet at least one of the following recovery location criteria:

a. In an area which would remove and use poor quality water (as defined in each AMA's Management Plan) as part of a DWR/DEQ or U.S. Environmental Protection Agency sanctioned water quality management program.

b. In such a location or designed in such a manner as to contribute to a DWR/DEQ or U.S. Environmental Protection Agency sanctioned corrective management program for a contaminant plume or poor groundwater quality area.

c. In an area experiencing a long-term average annual rate of decline that is less than 4.0 feet per year.

4. If the proposed recovery well is located within the service area of a city, town, private water company or irrigation district, that city, town, water company or irrigation district must be the entity recovering the water or must give consent to the recovery within its service area.

5. If the proposed recovery well is located within three miles of the boundaries of a service area of a city, town, private water company or irrigation district, the applicant must obtain consent from the closest service area provider.

6. For water stored outside of an AMA, recovery must occur in the same Irrigation Non-Expansion Area, groundwater basin or sub-basin in which the water was stored.

In addition to the previously described requirements for the location of recovery wells, a permit will be issued only if the following provisions are met:

7. If a new well (that is, a well drilled after June, 1980) is proposed for the recovery, or if an existing well (that is, a well drilled prior to June, 1980) owned by a person other than a city, town, private water company, irrigation district, or CAWCD, is proposed for the recovery, the Director must determine that the proposed recovery will not unreasonably increase damage to land or other water users. This determination is typically referred to as well impact analysis.

Policy Note 3: The determination of " unreasonably increasing damage" is made consistent with the procedures developed under our temporary well impact rules, R12-15-830 and 840.

8. If an existing well proposed for recovery is located within the applicant's service area and the applicant is a city, town, private water company or irrigation district within an AMA, no impact assessment is required, however, the applicant must have the right to use the well ("right to use" means the applicant must own or lease or otherwise have the legal right

to physically pump the well--it doesn't mean a separate right to pump groundwater).

9. If the applicant is a conservation district, (CAWCD) and the application is for an existing well within CAWCD's service area, and within the groundwater basin in which the stored water is located, again, the applicant need not pass well impact scrutiny, but must have a right to use the existing well.

Suggested Procedures for Review of Recovery Well Applications

The following procedures are suggested for Departmental review of all recovery well applications. Each of the divisions involved; Operations, Legal, AMAs, and Hydrology, is responsible for specific aspects of the overall review. However, previous experience has shown that having multiple reviewers increases the chance of identifying errors and omissions. Therefore, each reviewer should briefly review all aspects of an application. Procedures are designed to eliminate redundancy yet ensure that all statutory requirements are addressed. Reviews are subject to the 100 day deadline, therefore a rapid response is critical. A preliminary flow chart is attached which graphically illustrates the review process.

Step 1:

For recovery well permit applications submitted to ADWR, Operations will mark the date received and completeness/correctness deadline, make copies and distribute to the AMA, Legal, and Hydrology. For applications involving new wells (post code), Operations will also determine if the wells are associated with other existing permits for which impact determinations have been performed and attach copies of the permits to the application prior to distribution. Finally, the recovery well permit applications will be entered into the tracking system maintained by Operations.

Step 2:

Hydrology will determine if a recovery well is required to meet management plan/goal criteria based on the location of the well with respect to the AOI. Hydrology will validate the extent of the AOI for actively operating underground storage facilities based on information submitted with the most recent annual report. The AOI will either be the minimum AOI (1 mile safe harbor), or will be the calculated AOI based on actual recharge and recovery during the previous calendar year. Once the extent of the AOI is defined, Hydrology will determine if the proposed recovery well is inside the actual AOI and then determine if management plan criteria must be met based on the following considerations:

If the recovery well is inside the AOI and the applicant is

the storer, the well will not be evaluated for consistency with the management plan/goal.

If the recovery well is inside the AOI but the applicant is not the storer, the well will be evaluated for consistency with the management plan/goal (see Legal Requirements no.3 above).

If the recovery well is outside the AOI, the well will be evaluated for consistency with the management plan/goal.

Policy Note 4: The area of impact for a Groundwater Savings Facility is defined by the aerial extent of the service area boundary of the recipient (usually an irrigation district).

Step 3:

The AMA will determine if the proposed well is inside or within 3 miles of the boundaries of a service area of a city, town, private water company or irrigation district.

If the well is inside or within 3 miles of a service area, written consent to the recovery may be required, (see Legal Requirements nos. 4 and 5 above).

Policy Note 5: If the recovery well is a new (post code) well and is already limited to a certain maximum annual volume by an existing permit, the well owner must agree in writing that the cumulative annual volume of pumpage (both recovery and production) will not exceed the amount of the existing permit.

Step 4:

Hydrology will determine if proposed recovery wells require a well impact analysis based on whether the well is an existing, pre-code well, or a new, post-code well.

If the well was drilled prior to June 1980, and the applicant is a city, town, private water company, irrigation district, or CAWCD, a well impact assessment may not be necessary, (see Legal Requirements nos. 6, 7 and 8, above). The AMA will establish the applicant's right to use the well.

If the well was drilled prior to June 1980, but the applicant is not a city, town, private water company, irrigation district or CAWCD, a well impact assessment will be conducted (see Legal Requirements 6, 7 and 8, above).

If the well was drilled after June 1980, regardless of ownership, a well impact assessment will be conducted. This applies only when the proposed recovery exceeds the volume limitations imposed by any existing permits. In this case,

the well impact analysis will be done only for the increased amount. If the proposed recovery does not exceed the permit amount, a well impact analysis is not necessary. (see Legal Requirement 6, and Policy Note 5 above).

Step 5:

After conducting its review, the AMA will send a correctness memo to Operations after determining that the applicant has the right to use the well and has acquired the necessary consent to the recovery.

Step 6:

Hydrology will conduct the appropriate determinations and submit the results in the form of a completeness and correctness memo to the AMA and Operations. For management plan consistency, Hydrology will state whether each well meets or fails to meet the criteria described earlier. If a well fails to meet management plan consistency, evidence for this determination will be provided. For well impact assessments, Hydrology will calculate the radius of the 10 and 25 foot water level drawdown contours and provide this in a memo to Operations summarizing the analysis.

Step 7:

Operations will determine if any wells fall inside the 10 and 25 foot water level drawdown contours by accessing the Wells 55 and GWSI databases.

If wells belonging to entities other than the applicant fall inside the 25 foot drawdown contour, the application will be rejected. If wells fall within the area projected to have drawdowns greater that 10 feet but less than 25 feet, Operations will notify the AMA and then send an incorrectness letter to the applicant which states that ADWR has determined the potential for harm if the recovery well is pumped. The applicant is given the following options: a) obtain consent from potentially impacted well owner, b) relocate the proposed well, c) prove the well will not cause an impact, d) decrease the volume to lessen the impact. Operations will send notices to all potentially affected well owners informing them of the projected impacts on their wells. Copies of the notices are included with the Department's incorrectness letter to the applicant.

Step 8:

When it is determined that the requested recovery wells comply with all management plan and well impact analysis criteria, and the AMA has found the application correct, Operations sends a correctness letter to the applicant. A public notice is prepared by Operations, with oversight provided by the appropriate AMA, and

published in a local newspaper for 2 weeks. A 15 day public comment period allows an opportunity for potentially impacted parties to file a written protest. As soon as the public notice is sent out for publication, Operations will prepare a draft permit and route it with a Permit Development Form (PDF) to the AMA, Hydrology and Legal for review. The PDF will contain a menu of standard recovery well permit "special conditions" which may be included in the final permit. Comments will be returned to Operations for preparation of the final permit.

Step 9:

Assuming no protests are received, the AMA sends a final draft permit to the applicant for review along with an invoice for permit fees.

Step 10:

When the proper fees are collected by Operations the final permit is prepared by Operations and mailed to the applicant. Copies are distributed to all reviewers for filing.

Step 11:

The recharge database(s) are updated by the appropriate staff.

Hydrologic Review Procedures:

For recovery wells requiring a determination for consistency with management plan criteria, Hydrology will review all available sources of information to determine if any wells in the proximity of the proposed recovery well have undergone long term annual groundwater level declines of four feet per year or greater. The primary source of hydrologic data for this analysis will be the Groundwater Site Inventory (GWSI) database.

For recovery wells identified as requiring an impact analysis, Hydrology will assess well impacts consistent with the procedures developed and utilized by the Assured Water Supply Section. The Well Impact and Well Spacing rules, (R12-15-830), describe the criteria necessary to make a determination of "unreasonably increasing damage to surrounding land or water users" from a well or concentration of wells.

In general, unreasonable damage to adjacent wells occurs when the withdrawal from the proposed recovery well would cause greater than 10 feet of additional drawdown in the adjacent well over a 5 year period. If calculated drawdowns are between 10-25 feet, the applicant is given the opportunity to mitigate, (see step 6 above). If drawdowns exceed 25 feet, the application is rejected. The determination of unreasonable damage to surrounding land resulting

from the proposed recovery well is also cause for rejecting the application. If the well is located in an area of known land subsidence or poor water quality and hydrologic evidence suggests that proposed withdrawals would result additional subsidence or migration of poor quality water, the application can be rejected.

Analysis of impacts to adjacent wells will be based on the Theis Non-Equilibrium equation, an analytical solution that describes saturated flow in an aquifer. The equation can be rearranged to solve for hydraulic head drawdown as a function of radius around a pumping well. The area encompassed within the contours drawn from the calculated 10 and 25 foot radii defines a zone for determining acceptable impacts to adjacent wells. It is important to note that the Theis solution assumes an idealized aquifer and is constrained by the following assumptions:

1. the aquifer is horizonal
2. the aquifer is confined between impermeable formations
3. the aquifer is infinite in horizontal extent
4. the aquifer is of a constant thickness
5. the aquifer is homogeneous and isotropic
6. there is a single pumping well in the system
7. the pumping rate is constant with time
8. the well penetrates the entire aquifer
9. the hydraulic head of the aquifer prior to pumping is uniform throughout the aquifer
10. the well diameter is infinitesimally small.

If the actual system deviates significantly from this idealized system a degree of error is introduced into the solution.

In order to calculate the radius from the pumping well to a specific drawdown contour the following aquifer parameters must be known:

Q = well discharge rate (gpm)
T = aquifer transmissivity (gpd/ft)
Sy = specific yield (%)
St = saturated thickness of aquifer penetrated by well (ft)
t = time (5 years or 1,825 days)

Well discharge (Q) is assumed to equal the design pump capacity of the well listed on the application form. Reported design pump capacity may be inaccurate and is dependent on the condition of the pump, lift distance, saturated thickness, and aquifer parameters. Therefore, GWSI should be checked to see if a more accurate measured discharge rate is available. For wells drilled after June 1980, that have volume limitations imposed by existing permits, the Q used for well impact calculation is the amount of proposed recovery which exceeds existing permit volume. For example, if well production is presently limited to 2000 acre-feet/year and the additional proposed recovery would increase pumpage to 3000 acre-feet/year, the volume of recovery would be

1000 acre-feet per year. The new annual volume is converted to an equivalent annual discharge rate by dividing acre-feet per year by 1.61.

Aquifer parameters T, Sy, and St will be determined in most cases from available information. Care must be taken to ensure accurate values are selected since the solution is most sensitive to these parameters. Sources of information include: GWSI, ADWR Groundwater Modeling Reports, Assured Water Supply reports, USGS reports and other published data. The source of the aquifer parameters used for the calculation will be documented. If no valid source of data can be found, the applicant can be required to conduct an aquifer test to develop the data.

Hydrology will calculate the drawdown at the well and the radius of the 10 and 25 foot drawdown contours caused by the pumping well after 5 years of continuous pumping. Calculations can be performed by hand, or by using computer programs such as THWELLS or QUICKFLOW and documented on the Recovery Well Impact Analysis Review Sheet (attached). A generic map will also be provided that illustrates the location of the subject well and the various drawdown contours.